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# **The experience of breast pain (mastalgia) in female runners of the 2012 London Marathon and its effect on exercise behaviour**

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## **ABSTRACT**

**BACKGROUND** For female marathon runners' breast pain (mastalgia) may be an important issue which has yet to be considered. This study aimed to determine the prevalence and severity of mastalgia in female marathon runners, identify factors that increase mastalgia and methods used to overcome mastalgia, and explore the impact that mastalgia may have on marathon training.

**METHODS** 1397 female marathon runners were surveyed at the 2012 London Marathon Registration. All participants who completed the four part, 30 question survey in its entirety have been included in the analysis (n = 1285).

**RESULTS** 32% of participants experienced mastalgia. This was significantly related to cup size and was greater during vigorous compared to moderate physical activity. Exercise-related factors were the primary factors reported to increase mastalgia participation. 17% of symptomatic participants reported that mastalgia affected their exercise behaviour. Methods reportedly used to overcome mastalgia included pain

medication and firm breast support; however 44% of participants took no measures to relieve symptoms despite over half describing their mastalgia as discomforting.

**CONCLUSION** Mastalgia was experienced by a third of marathon runners and was found to be related to breast size which has previously been unreported. The link between exercise and mastalgia has yet to be established, however this study identified that exercise was the most prevalent factor in mastalgia occurrence which may have implications for its management. The number of participants who took no measures to relieve their mastalgia, or resorted to pain medication, highlights the importance and significance of research into exercise-related mastalgia.

## **WHAT ARE THE NEW FINDINGS**

- A third of female marathon runners experienced mastalgia which increased with cup size, body mass index and activity level, but was not related to age.
- Over half of symptomatic females described the severity of mastalgia as discomforting however 44% had done nothing to relieve their symptoms.
- Seventeen percent of females reported that their mastalgia resulted in changes in their exercise behaviour.

## **HOW MIGHT IT IMPACT ON CLINICAL PRACTICE IN THE NEAR FUTURE?**

- The results highlight the need for the advancement of appropriate and effective treatment methods of mastalgia and may aid the development of educational initiatives for females and health practitioners to effectively manage mastalgia symptoms.
- The link between exercise and mastalgia has yet to be established, however this study identified that exercise was the most prevalent factor in mastalgia occurrence which may have implications for its management.

## INTRODUCTION

Mastalgia is a common health experienced by up to two thirds of the general female population.[1-2] Mastalgia can impact the health and well-being of females interfering with social, physical and sexual and work-related activities.[3-4] Most clinical classifications distinguish between non-cyclic and cyclic mastalgia.[5] Non-cyclic mastalgia is defined as constant or intermittent pain that is unrelated to the menstrual cycle.[6-7] Cyclic mastalgia is thought to have a hormonal etiology and is most prominent towards the end of the menstrual cycle.[5,8-9] A third type of mastalgia has been identified and is classified as extramammary pain, which is felt within the breast but originates from the chest wall or other sources.[6,10] Additionally, excessive breast motion during physical activity has been reported to result in exercise-related mastalgia.[11-13]

After a thorough breast health history, breast examination and in some instances breast imaging, education and reassurance are considered as a first line treatment for mastalgia.[1,14-15] A variety of other treatment modalities have been investigated, however these have varied results and the placebo response in most trials is significant.[10] Pharmacological management of mastalgia is not indicated as a first line treatment as commonly prescribed medications (tamoxifen, danazol and bromocriptine) are often poorly tolerated and provide only temporary relief.[5,10,16] Other approaches include diet and nutritional intervention, however despite fat and caffeine being identified as causal factors of mastalgia, limited research has investigated the efficacy of reducing fat intake,[17] and reducing caffeine intake is not advocated.[10] In a retrospective audit of the efficacy of surgery in severe

mastalgia Davies et al.[18] reported that less than 1% of 1054 patients had surgery for mastalgia. Furthermore, high complication and relapse rates were evident following surgery. In contrast, wearing a well-fitting supportive bra has been reported to relieve mastalgia symptoms in 85% of patients with no associated side-effects [9] and is recommended for the relief of cyclic and non-cyclic mastalgia.[10]

Appropriate breast support is particularly important for exercising females due to the limited anatomical support.[19] This lack of intrinsic breast support can cause excessive breast motion during physical activity[11-13,20-22] and is hypothesised to increase tension and stretching of the supporting structures of the breast leading to exercise-induced mastalgia.[9,11,20-22] Up to 72% of exercising females are reported to experience exercise-induced mastalgia[23] and although the mechanical properties of suspensory structures of the breast are unknown, greater strain on the breast is reported during running compared to walking[24] and it was approximated that maximum breast loading could reach up to 50N during running.[19]

Marathon running has increased in popularity among individuals of all ages and abilities in recent years [25-27] with an exponential rise observed in female marathon participation. [28] Previous studies of marathon runners have focused on a variety of physical,[26,29] physiological,[30-32] and psychological[33] implications of marathon training and participation. For female marathon runners mastalgia may be an important issue which has yet to be considered, but may have implications in terms of performance, participation and discomfort during exercise. However no literature has investigated mastalgia in a marathon population.[26]

Therefore this study aims to:

- Determine the prevalence and severity of mastalgia in female marathon runners.
- Identify factors that increase mastalgia and report the methods currently utilised to overcome mastalgia.
- Explore the impact that mastalgia may have on exercise behaviour.

## **METHODS**

Following full institutional ethical approval, a four-part, 30 question survey (including participant information sheet) was administered to a convenience sample of females passing through the registration zone at the 2012 London Marathon exhibition. To ensure a high return rate surveys were completed immediately, and collected. All data were anonymous. An on-line survey was made available to participants that declined the invitation to complete the survey. The questions and format of the on-line survey were identical to the paper-based survey to demonstrate equivalency and increase reliability of the mixed-mode strategy.[34] The on-line survey remained accessible for two weeks following the survey. Ethically approved prize draw entry (£250 of generic high street vouchers) was offered to all participants on completion of the survey as an incentive to increase response rate.[35-36]

The survey included multiple-choice, likert scale and free-text format questions and was designed to take no more than 10 minutes to complete. Section 1 of the survey identified the physical activity history [37] and marathon experience of participants. Section 2 explored breast support considerations of participants, the results of which

are reported elsewhere. Section three of the survey focused on mastalgia and was an adaptation of the McGill Pain Questionnaire,[38] with extended questions to explore methods used to relieve mastalgia and the impact that mastalgia may have on marathon training. Section 4 identified demographic data and information about breast health history. Minor amendments were made to wording and question order prior to use, following a pilot-test on amateur runners (n = 10).

A total of 1397 surveys were collected and following standardised training, a team of researchers inputted survey responses into Microsoft Excel (2010). The dataset had few missing data and items with missing values were listwise deleted, resulting in a final sample size of 1285 for all subsequent analyses. Participants had an average body mass [standard deviation (SD)] of 62.7 kg ( $\pm$  8.9 kg), stature 1.65 m ( $\pm$  0.7 m), and body mass index (BMI) of 22.9 kg.m<sup>-2</sup> ( $\pm$  3.0 kg.m<sup>-2</sup>). Cup size ranged from an AA cup to an HH cup with underband size ranging from 28 to 40 inches. In total fifty-six bra sizes were reported with a mode bra size of 34B (15.5%). 91% of participants reported always wearing a sports bra during running and 86% considered wearing a sports bra to be essential.

## **Data analysis**

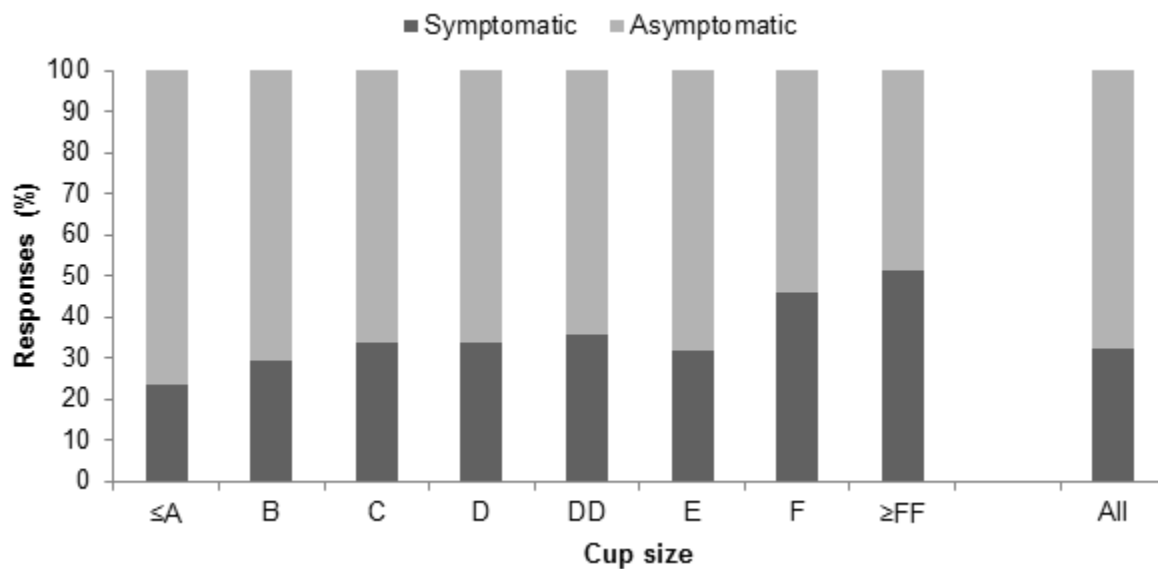
Data were analysed descriptively to summarise participant's demographic profiles and prevalence of mastalgia. All statistical analyses were performed using Predictive Analytic Software (PASW) statistics computer package with statistical significance set at 0.05. Non-parametric differences in self-reported physical characteristics, physical activity history and predicted marathon finish time of symptomatic and asymptomatic participants were assessed using multiple Mann-Whitney *U* tests. Wilcoxon Signed

rank tests were used to identify differences in the prevalence of mastalgia in moderate and vigorous physical activity. Chi-squared analysis was used to assess the association of mastalgia with cup size, age, and physical activity level. Cup sizes AA and A ( $\leq A$ ) and FF to HH inclusive ( $\geq FF$ ) condensed to meet Chi-square assumptions.[39] The half decade groups of 60 to 64 years, 65 to 69 years and 70 to 74 years were also condensed to one group ( $\geq 60$  years) to create 9 age groups.

## RESULTS

### Prevalence and severity of mastalgia

Almost one-third (32%) of participants reported experiencing mastalgia (Fig.1) and this was significantly related to cup size ( $X^2 = 17.432$ ,  $p < 0.05$ ) increasing linearly (Fig.1). Mastalgia was not related to participant's age ( $X^2 = 9.839$ ,  $p > 0.05$ ).



**Fig. 1.** Prevalence of mastalgia across breast cup size (n = 1279\*)

\*6 people reported not knowing their cup size



There were no significant differences in the physical activity history and marathon experience of symptomatic and asymptomatic participants, however BMI was significantly lower in asymptomatic participants ( $z = -3.046$ ,  $p < 0.05$ ) (Table 1).

**Table 1.** Self-reported physical characteristics, physical activity history and marathon experience of symptomatic ( $n = 412$ ) and asymptomatic ( $n = 837$ ) participants

	Symptomatic ( $n = 412$ )	Asymptomatic ( $n = 873$ )	All ( $n = 1285$ )
<b>Stature (m)</b>	$1.65 \pm 0.7$	$1.65 \pm 0.7$	$1.65 \pm 0.7$
<b>Body mass (kg)</b>	$63.2 \pm 9.4$	$62.4 \pm 8.6$	$62.7 \pm 8.9$
<b>Body mass index (<math>\text{kg} \cdot \text{m}^{-2}</math>)</b>	$23.1 \pm 3.1$	$22.8 \pm 2.9^*$	$22.9 \pm 3.0$
<b>Duration of typical exercise session (mins)</b>			
Moderate intensity	$70.1 \pm 45.6$	$74.3 \pm 53.2$	$72.9 \pm 50.9$
Vigorous intensity	$73.5 \pm 58.1$	$68.8 \pm 50.2$	$70.3 \pm 52.9$
<b>Number of days exercise in a typical week</b>			
Moderate intensity	$3.8 \pm 1.7$	$3.9 \pm 1.6$	$3.8 \pm 1.7$
Vigorous intensity	$3.0 \pm 1.7$	$2.9 \pm 1.6$	$2.9 \pm 1.6$
<b>Predicted marathon finish time (mins)</b>			
London 2012 marathon	$284.7 \pm 44.6$	$281.6 \pm 45.1$	$282.6 \pm 45.0$
<b>Marathons previously completed</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
London 2012 first marathon	244 (59%)	486 (56%)	730 (57%)
1 -2 marathons	107 (26%)	208 (24%)	315 (24%)
3 - 4 marathons	24 (6%)	89 (10%)	113 (9%)
$\geq 5$ marathons	37 (9%)	90 (10%)	127 (10%)

*All values are presented as mean  $\pm$  SD unless otherwise stated. Moderate intensity (activities requiring moderate physical effort and causing small increases in breathing or heart rate and vigorous intensity (activities requiring hard physical effort and large increases in breathing or heart rate).*

*\*denotes significant difference at  $< 0.05$  level*

Forty-six percent of participants reported that they had given birth to one or more children, of whom 88% reported they had breast fed their child/children. Mastalgia was significantly related to parity ( $\chi^2 = 7.753$ ,  $p < 0.05$ ) with significantly more

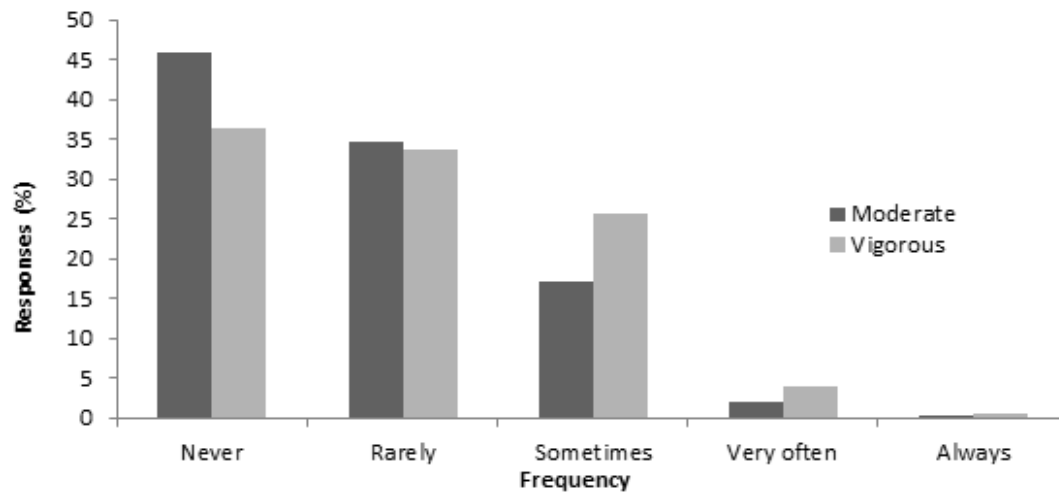
nulliparous participants experiencing mastalgia (35%) compared to parous participants (28%).

Of the 412 (32%) participants that reported experiencing mastalgia 52% reported that this was related to their menstrual cycle, and 30% that it was sometimes related to their menstrual cycle. The severity, distress level, frequency and duration of mastalgia reported by participants is shown in Table 2. Over half (52%) of symptomatic participants described the severity of their mastalgia as discomforting, with a further 8% reporting the severity as either distressing, horrible, or excruciating. Nearly three-quarters (74%) of participants reported some level of distress as a consequence of mastalgia.

**Table 2.** Severity, distress level, frequency and duration of mastalgia (n = 412)

<b>Severity of mastalgia</b>	Mild 40%	Discomforting 52%	Distressing 5%	Horrible 2%	Excruciating 1%
<b>Distress level of mastalgia</b>	Not at all 26%	A little bit 54%	Somewhat 15%	Quite a bit 4%	Very much 1%
<b>Frequency of mastalgia</b>	Hourly 3%	Daily 11%	Weekly 8%	Monthly 47%	2-3 months 31%
<b>Duration of mastalgia</b>	Momentary 12%	Brief 34%	Transient 28%	Steady 20%	Continuous 6%

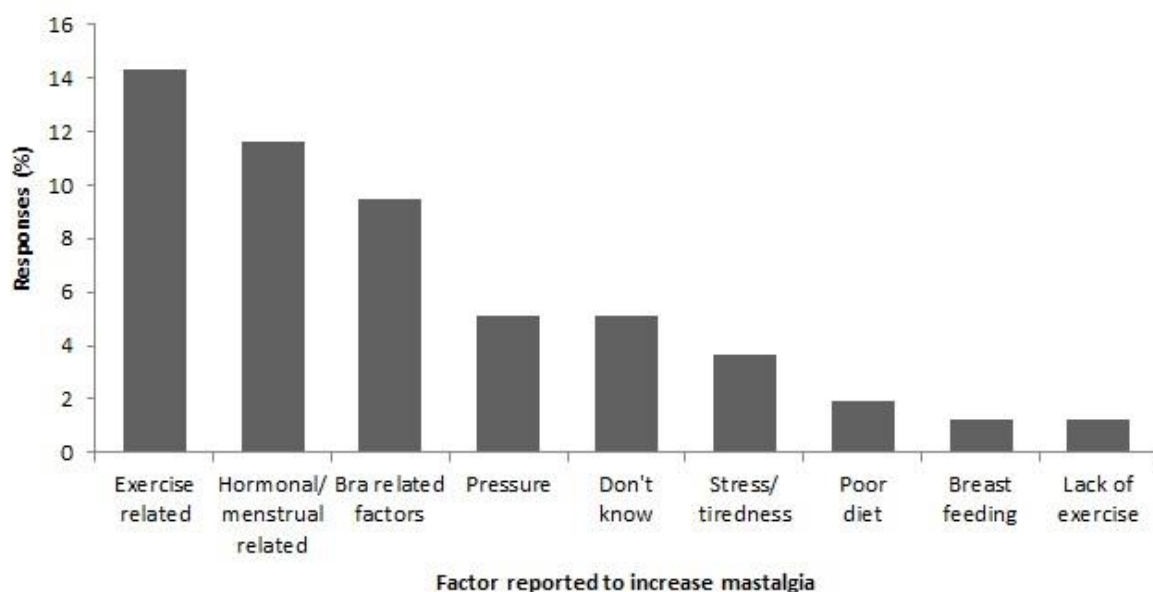
The prevalence of mastalgia was reported to be significantly lower in moderate physical activity compared to vigorous physical activity ( $Z = -7.931$ ,  $p < 0.05$ ) with 54% of participants experiencing mastalgia during moderate physical activity, compared to 64% during vigorous physical activity (Fig.2).



**Fig. 2.** Prevalence of mastalgia in moderate and vigorous physical activity (n = 412)  
*Moderate intensity (activities requiring moderate physical effort and causing small increases in breathing or heart rate) and vigorous intensity (activities requiring hard physical effort and large increases in breathing or heart rate)*

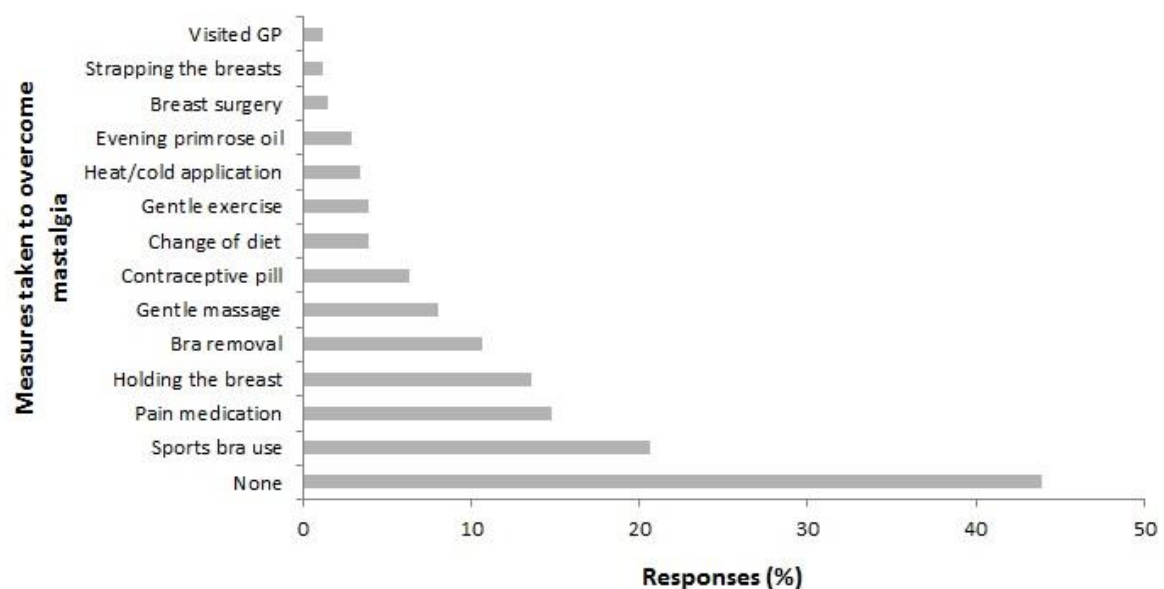
### Factors reported to increase mastalgia and methods utilised to relieve mastalgia

The most prevalent factors reported to increase participants' mastalgia were related to exercise participation (14%) (Fig.3). Hormonal/menstrual related factors were reported by 12% of participants and bra related factors such as wearing an ill-fitting and/or unsupportive bra were reported by 10% of participants.



**Fig. 3:** Factors reported to increase mastalgia (n = 412)

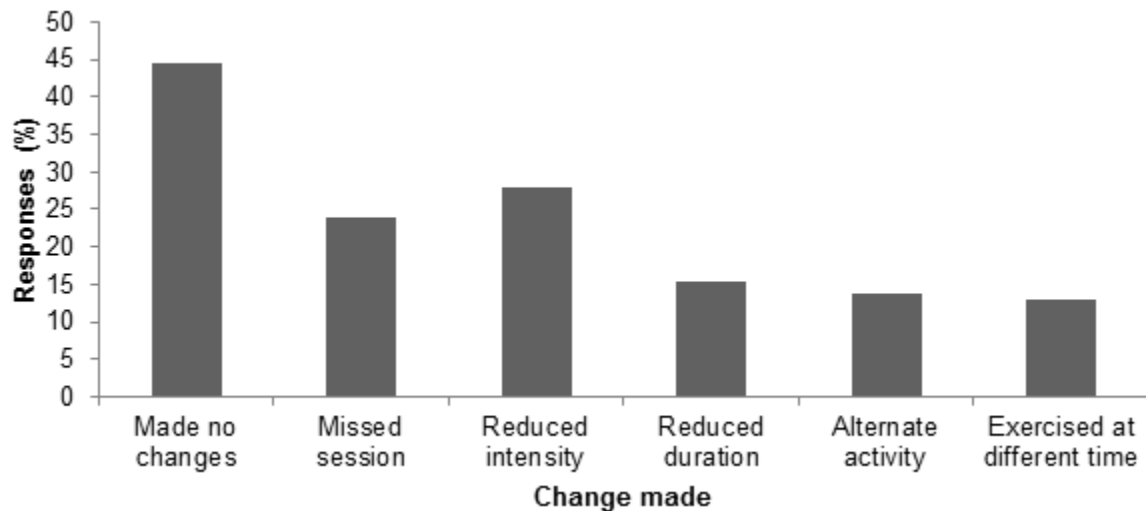
Participants were given the opportunity to select from a range of factors that they had used to relieve mastalgia, in addition to providing free-text responses (Fig.4). 44% of participants reported having taken no measures to relieve their mastalgia. A variety of methods were reportedly used by the remaining participants to relieve mastalgia, with the most popular sports bra use (21%) pain medication (15%) and holding the breast (14%).



**Fig. 4.** Measures taken to overcome mastalgia (n = 412)

### Impact of mastalgia on exercise behaviour

Of the 412 participants that experienced mastalgia, 17% reported that mastalgia affected their participation in exercise. Of these, 29% reported that it rarely affected their participation, 57% sometimes, 10% very often and 3% always. Figure 5 identifies the participants' changes in exercise behaviour as a result of mastalgia.



**Fig. 5.** Changes made to exercise behaviour due to mastalgia (n = 70)<sup>\*\*\*</sup>

## DISCUSSION

### Prevalence and severity of mastalgia

A third of female marathon runners experienced mastalgia. Over half of these participants described the severity of mastalgia as discomforting and reported some level of distress as a consequence of mastalgia. This highlights the need to investigate this important quality of life issue for exercising women. The prevalence of mastalgia increased with cup size, ranging from 24% in participants with  $\leq$  A cup size breasts to 51% in participants with  $\geq$  F cup size breasts. This is an important finding as it has yet to be established whether breast size is related to mastalgia, due to the small sample sizes in previous studies. Furthermore, it indicates that the condition is not restricted to only larger-breasted women. The prevalence of mastalgia in the present study was also higher in nulliparous participants compared to parous participants. The breast reaches its most differentiated status following parturition [40-41] and investigating the variation in breast composition at different

life stages and the association of composition with mastalgia may also provide further insight into the etiology and management of mastalgia.

Over a fifth of symptomatic participants reported experiencing mastalgia at some time during exercise. This highlights the need for the advancement of appropriate and effective treatment methods of mastalgia to allow females to exercise in comfort, and confirms the significance and importance of research into exercise-related mastalgia. Participants reported experiencing mastalgia significantly more frequently during vigorous physical activity compared to moderate physical activity. This suggests that activity-level specific support may have implications with regard to mastalgia, although further understanding of this association is needed in order to inform breast support design.

It could be suggested that female runners who did not experience mastalgia may have viewed their participation in the study as redundant, and thus declined to take part in the study. Consequently the prevalence of mastalgia in female marathon runners may be lower than one third. However, the survey focused on a number of areas related to the breast, and was described as a breast health questionnaire, thus avoiding a specific focus on mastalgia. Additionally the face-to-face recruitment methodology employed resulted in a high response rate representing 10% of all female runners in the 2012 London Marathon.

## **Factors reported to increase mastalgia and methods utilised to overcome mastalgia**

Exercise related factors were most commonly reported to increase mastalgia in female marathon runners. It is therefore important to identify appropriate strategies and treatment modalities to reduce mastalgia when exercising, in order to allow women to exercise in comfort. Hormonal/menstrual related factors were also reported to increase mastalgia, supporting previous research that indicates mastalgia is hormonally mediated.[5,8-9]. An ill-fitting and/or unsupportive bra was reported by 10% of participants to increase mastalgia highlighting the importance of appropriate, well-fitting breast support. As suggested by White & Scurr[42] educational initiatives to aid women in selecting appropriate, correctly fitting breast support are warranted. The benefits of a well-fitted sports bra in reducing mastalgia and breast motion are well documented[9,11,20-22] and in the present study the use of a sports bra was the most commonly reported method used to relieve mastalgia (21%). However 91% of participants reporting always wearing a sports bra when running suggesting that sports bra use is not necessarily perceived as a method to treat mastalgia, and that sports bra design and manufacture needs improvement.

Although pharmacological treatments can provide temporary relief of mastalgia, this can be associated with negative side effects and should only be considered when first line treatments are ineffective [10]. However, the second most commonly used method to relieve mastalgia in the present study was pain medication (15%). This highlights the importance and significance of research into the treatment of mastalgia and demonstrates the need for prospective evaluation into treatment modalities. This

is further evidenced by the 44% of participants who reported taking no measures to overcome mastalgia.

### **Impact of mastalgia on exercise behaviour**

In the present study 17% of participants experiencing mastalgia reported that it influenced their participation in exercise. The interference of mastalgia on physical activity has previously been reported to range between 29%[1] and 37%[3] however it is noted that these studies comprised of clinic-based samples as opposed to highly active individuals and were conducted over 16 years ago. Elevated pain thresholds and pain tolerance in marathon runners have been reported,[43] which may partly explain the lower prevalence of mastalgia in the present study. Furthermore, it could be postulated that due to the intense demands of marathon training some individuals experiencing mastalgia may have been unable to race/complete training, resulting in an under-estimation of the impact of mastalgia on exercise participation.

Beyond reporting the influence of mastalgia on normal physical activity levels, precise changes to exercise behaviour as a result of mastalgia have not been previously investigated. Over a quarter of female marathon runners experiencing mastalgia in the present study reduced the intensity of their exercise and a fifth had missed an exercise session as a result of mastalgia. Other changes included reducing the duration of activity, participating in an alternative activity, or re-scheduling. These results suggest that for some, mastalgia may have negative consequences on marathon preparation, and thus is an issue to address.



## **CONCLUSION**

In conclusion, the results of this large scale survey suggest that a third of female marathon runners experience mastalgia. Additionally mastalgia was found to be significantly related to breast size which has previously been undetermined. Exercise was the primary factor reported to increase mastalgia, highlighting the importance and significance of research in to exercise-related mastalgia to allow women to exercise in greater comfort. Over half of symptomatic women described the severity of mastalgia as discomforting and three-quarters reported some level of distress as a consequence of mastalgia. Despite this, just under half of the women had taken no action to relieve their symptoms. The link between exercise and mastalgia has yet to be established, however, this study identified that exercise was the most prevalent factor in mastalgia occurrence. Seventeen percent of women reported that their mastalgia interfered with their exercise participation.

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